Basic Machines

Only one answer sheet is included in the NRTC. Reproduce the required number of sheets you need or get answer sheets from your ESO or designated officer.

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BASIC MACHINES

NAVEDTRA 82199

Prepared by the Naval Education and Training Program Management
Support Activity, Pensacola, Florida

Congratulations! By enrolling in this course, you have demonstrated a desire to improve
yourself and the Navy. Remember, however, this self-study course is only one part of the
total Navy training program. Practical experience, schools, selected reading, and your
desire to succeed are also necessary to successfully round out a fully meaningful training
program. You have taken an important step in self-improvement. Keep up the good work.

HOW TO COMPLETE THIS COURSE SUCCESSFULLY

ERRATA: If an errata comes with this course,
make all indicated changes or corrections
before you start any assignment. Do not
change or correct the Training Manual
(TRAMAN) or assignments in any other way.

TEXTBOOK ASSIGNMENTS: The TRAMAN for this
course is *BASIC MACHINES*. NAVEDTRA 12199.
The TRAMAN pages that you are to study are
listed at the beginning of each assignment.
Study these pages carefully before attempting
to answer the questions in the course. Pay
close attention to tables and illustrations
because they contain information that will
help you understand the text. Read the
learning objectives provided at the beginning
of each chapter or topic in the text and/or
preceding each set of questions in the
course. Learning objectives state what you
should be able to do after studying the
material. Answering the questions correctly
helps you accomplish the objectives.

BLACK DOT INFORMATION: Black dots (●) may be
used in the text and correspondence course to
emphasize important or supplemental
information and to highlight instructions for
answering certain questions. Read these
black dot entries carefully; they will help
you answer the questions and understand the
material.

SELECTING YOUR ANSWERS: After studying the
TRAMAN, you should be ready to answer the
questions in the assignment. Read each
question carefully, then select the BEST
answer. Be sure to select your answer from
the subject matter in the TRAMAN. You may
refer freely to the TRAMAN and seek advice
and information from others on problems that
may arise in the course. However, the
answers must be the result of your own work
and decisions. You are prohibited from
referring to or copying the answers of
others and from giving answers to anyone
else taking the same course. Failure to
follow these rules can result in suspension
from the course and disciplinary action.

SUBMITTING   COMPLETED   ANSWER   SHEETS:
Complete all assignments as quickly as
possible to derive maximum benefit from the
course. As a minimum, you must submit at
least one assignment per month. This is a
requirement established by the Chief of
Naval Education and Training. Failure to
meet this requirement could result in
disenrollment from the course.

TYPES OF ANSWER SHEETS: If you are a U.S.
Navy enlisted member on active duty or a
drilling U.S. Naval Reserve enlisted member,
you should use the answer sheet attached at
the end of this course and follow the
instructions in section A below. If you are
an enlisted U.S. Naval Reserve member who is
not attached to a drilling unit or if you
are an officer, a civilian, or a member of
the U.S. Army, Air Force, Marine Corps, or
Coast Guard, you should use the Automatic
Data Processing (ADP) answer sheets included
in the course package and follow the
instructions in section B.

A. Manually Scored Answer Sheets

If you are a U.S. Navy enlisted member on active duty or attached to a U.S. Naval Reserve drilling unit, your course will be administered by your local command. You must use the answer sheet designed for manual scoring, NETPMSA form 1430/5, Stock Ordering Number 0502-LP-216-0100. You may get a supply of the forms from your Educational Services Officer (ESO), or you may reproduce the one in the back of this course booklet. DO NOT USE THIS FORM FOR COURSES ADMINISTERED BY NETPMSA.

Recording Information on the Manually Scored Answer Sheets: As you complete each assignment, submit the completed answer sheet to your ESO for grading. You may submit more than one answer sheet at a time. Remember, you must submit at least one assignment each month.

Grading: Your ESO will grade each answer sheet and notify you of any incorrect answers. The passing score for each assignment is 3.2. If you receive less than 3.2 on any assignment, the ESO will list the questions you answered incorrectly and give you an answer sheet marked "RESUBMIT." You must redo the assignment and complete the RESUBMIT answer sheet. The maximum score you can receive for a resubmitted assignment is 3.2.

Course Completion: After you have submitted all the answer sheets and have earned at least 3.2 on each assignment, your command should give you credit for this course by making the appropriate entry in your service record.

Student Questions: If you have questions concerning the administration of this course, consult your ESO.

B. ADP Answer Sheets

If you are an enlisted U.S. Naval Reserve member who is not attached to a drilling reserve unit or if you are an officer, a civilian, or a member of the U.S. Army , Air Force, Marine Corps, or Coast Guard, use the ADP answer sheets provided in your course package. You should use one blank original ADP answer sheet for each assignment. Use only the original ADP answer sheet provided in your course package; NETPMSA will not accept reproductions.

Recording Information on the ADP Answer Sheets: Follow the "MARKING INSTRUCTIONS" on each answer sheet. Be sure that blocks 1, 2, and 3 are filled in correctly. This information is necessary for your course to be properly processed and for you to receive credit for your work.

As you work the course, be sure to mark your answers in the course booklet because your answer sheets will not be returned to you. When you have completed an assignment, transfer your answer from the course booklet to the answer sheet.

Mailing the Completed ADP Answer Sheets: Upon completing an assignment, mail the completed answer sheet to:

COMMANDING OFFICER
NETPMSA CODE 074
6490 SAUFLEY FIELD RD
PENSACOLA FL 32559-5000

Use envelopes to mail your answer sheets. You must provide your own envelopes or request them from your ESO. You may enclose more than one answer sheet in a single envelope. Remember, regardless of how many answer sheets you submit at a time, NETPMSA should receive at least one assignment a month.

NOTE: DO NOT USE THE COURSE COMMENTS PAGE AS AN ENVELOPE FOR RETURNING ANSWER SHEETS OR OTHER COURSE MATERIALS.

Grading: NETPMSA will grade the answer sheets and notify you by letter concerning your grade for each assignment, your incorrect answers, and your final grade. The passing score for each assignment is 3.2. If you receive less than 3.2 on any assignment, you must rework the assignment. NETPMSA will enclose a new ADP answer sheet in the letter notifying you of the questions you answered incorrectly. You will be required to redo the assignment and resubmit the new answer sheet. The maximum score you can receive for a resubmitted assignment is 3.2.

Course Completion: When you complete the last assignment, fill out the "Course Completion" form in the back of the course and enclose it with your last answer sheet. NETPMSA will issue you a letter certifying that you satisfactorily completed the course. You should make sure that credit for the course is recorded in your service record. YOU MAY RETAIN THE TEXT.

NOTE: YOUR OFFICIAL COURSE COMPLETION DATE WILL BE THE DATE YOUR LAST ASSIGNMENT IS PROCESSED THROUGH THE NETPMSA ADP SYSTEM--NOT THE DATE YOU DEPOSIT THE LAST ASSIGNMENT IN THE MAIL. This is especially important if you are taking the course for Naval Reserve retirement credit. You must mail your answer sheets at least 60 days before your anniversary date. This will provide you with enough time for delays in the mail or reworking failed assignments. DO NOT MAIL YOUR ASSIGNMENTS TO THE NAVAL RESERVE PERSONNEL COMMAND (NRPC).

Student Questions: Refer questions concerning this course to NETPMSA by mail (use the address on page ii) or by telephone: DSN 922-1366 or commercial (904) 452-1366.

NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you will receive retirement points if you are authorized to receive them under current directives governing retirement of Naval Reserve personnel. For the purpose of Naval Reserve retirement, this edition of the course is evaluated at 6 points. These points will be credited to you upon your satisfactory completion of the entire course.

NOTE: YOUR OFFICIAL COURSE COMPLETION DATE WILL BE THE DATE YOUR LAST ASSIGNMENT IS PROCESSED THROUGH THE NETPMSA ADP SYSTEM--NOT THE DATE YOU DEPOSIT THE LAST ASSIGNMENT IN THE MAIL. Refer to the Course Completion paragraph under section B. ADP Answer Sheets.

COURSE OBJECTIVES

Upon completing this course, the student will demonstrate an understanding of course materials by correctly answering questions on the following: concepts and principles of operation of basic mechanical devices, and the construction and method of operation of common mechanical devices, such as engines and transmissions.

Naval courses may include several types of questions—multiple-choice, true-false, matching, etc. The questions are not grouped by type but by subject matter. They are presented in the same general sequence as the textbook material upon which they are based. This presentation is designed to preserve continuity of thought, permitting step-by-step development of ideas. Not all courses use all of the types of questions available. The student can readily identify the type of each question, and the action required, by inspection of the samples given below.

MULTIPLE-CHOICE   QUESTIONS

Each question contains several alternatives, one of which provides the best answer to the question. Select the best alternative, and blacken the appropriate box on the answer sheet.

SAMPLE

s-1.   Who was the first person appointed Secretary of Defense under the National Security Act of 1947?

   1. George Marshall
   2. James Forrestal
   3. Chester Nimitz
   4. William Halsey

Indicate in this way on the answer sheet:

	1 T	2 F	3	4	
s-1	☐	■	☐	☐	_ _ _

TRUE-FALSE QUESTIONS

Mark each statement true or false as indicated below. If any part of the statement is false the statement is to be considered false. Make the decision, and blacken the appropriate box on the answer sheet.

SAMPLE

s-2. All naval officers are authorized to correspond officially with any systems command of the Department of the Navy without their respective commanding officer's endorsement.

   1. True
   2. False

Indicate in this way on the answer sheet:

	1 T	2 F	3	4	
s-2	☐	■	☐	☐	_ _ _

MATCHING QUESTIONS

Each set of questions consists of two columns, each listing words, phrases or sentences. The task is to select the item in column B which is the best match for the item in column A that is being considered. Items in column B maybe used once, more than once, or not at all. Specific instructions are given with each set of questions. Select the numbers identifying the answers and blacken the appropriate boxes on the answer sheet.

SAMPLE

In questions s-3 through s-6, match the name of the shipboard officer in column A by selecting from column B the name of the department in which the officer functions. Some responses maybe used once, more than once, or not at all,

A. OFFICER	B. DEPARTMENT
s-3 . Damage Control Assistant	1. Operations Department
s-4. CIC Officer	2. Engineering Department
s-5 . Disbursing Officer	3. Supply Department
s-6. Communications Officer	

Indicate in this way on the answer sheet:

	1 T	2 F	3	4	
s-3	☐	■	☐	☐	_ _ _
s-4	■	☐	☐	☐	_ _ _
s-5	☐	☐	■	☐	_ _ _
s-6	■	☐	☐	☐	_ _ _

ASSIGNMENT 1

Textbook Assignment: "Levers," chapter 1, pages 1-1 through 1-8; Block and Tackle," chapter
                        2, pages 2-1 through 2--6; "The Wheel and Axle," chapter 3, pages 3-1
                        through 3-6; "The Inclined Plane and the Wedge," chapter 4, pages: 4-1
                        through 4-2.

1-1.   A chain hoist lifts a 300-pound
        load through a height of 10 feet
        because it enables you to lift the
        load by exerting less than 300
        pounds of force over a distance of
        10 feet or less.

        1. True
        2. False

1-2.   When a chain hoist is used to
        multiply the force being exerted on
        a load, the chain is pulled at a
        faster rate than the load travels.

        1. True
        2. False

1-3.   What are the six basic simple
        machines?

        1. The lever, the block and
            tackle, the inclined plane, the
            engine, the wheel and axle, and
            the gear
        2. The lever, the block and
            tackle, the wheel and axle, the
            screw, the gear, and the
            eccentric
        3. The lever, the block and
            tackle, the wheel and axle, the
            inclined plane, the screw, and
            the gear
        4. The lever, the inclined plane,
            the gear, the screw, the
            fulcrum, and the torque

1-4.   Which of the following basic
        principles is recognized by
        physicists as governing each simple
        machine?

        1. The wedge or the screw
        2. The wheel and axle or the gear
        3. The lever or the inclined plane
        4. The block and tackle or the
            wheel and axle

1-5.   Which of the following simple
        machines works on the same
        principle as the inclined plane?

        1. Screw
        2. Gear
        3. Wheel and axle
        4. Block and tackle

1-6.   The fundamentally important points
        in any lever problem are (1) the
        point at which the force is
        applied, (2) the fulcrum, and (3)
        the point at which the

        1. lever will balance
        2. resistance arm equals the
            effort arm
        3. mechanical advantage begins to
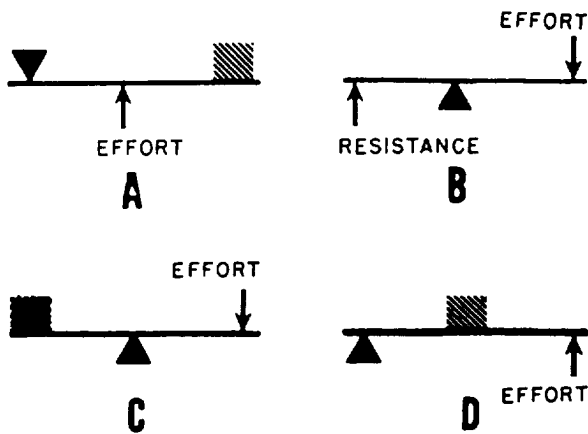   increase
        4. resistance is applied

1

Figure 1A.

QUESTIONS 1-7 THROUGH 1-9 RELATE TO THE DRAWINGS IN FIGURE 1A.

1-7. Which, if any, of the following parts illustrates a first class lever?

1. A
2. B or C
3. D
4. None of the above

1-8. Which part illustrates a second-class lever?

1. D
2. C
3. B
4. A

1-9. What part illustrates a third-class lever?

1. A
2. B
3. C
4. D

1-10. Which of the following classes of levers should you use to lift a large weight by exerting the least effort?

1. First-class
2. Second-class
3. First- or second-class
4. Third-class

1-11. You will find it advantageous to use a third-class lever when the desired result is

1. a transformation of energy
2. an increase in speed
3. a decrease in applied effort
4. a decrease in speed and an increase in applied effort
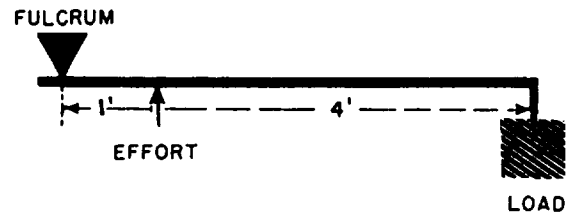
Figure 1B

IN ANSWERING QUESTIONS 1-12 THROUGH 1-14, SELECT THE CORRECT ARM MEASUREMENTS FROM FIGURES 1B AND 1C.

1-12. Effort arm in figure 1B

1. 1 ft
2. 3 ft
3. 4 ft
4. 5 ft

1-13. Resistance arm in figure 1B

1. 1 ft
2. 3 ft
3. 4 ft
4. 5 ft

1-14. Resistance arm in figure 1C

1. 1 ft
2. 3 ft
3. 4 ft
4. 5 ft

2
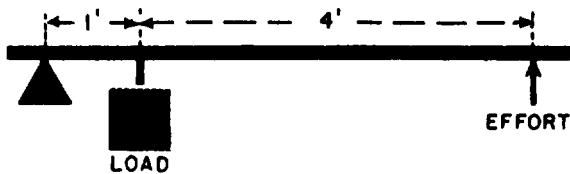
Figure 1C

1-15. Two boys find that they can balance each other on a plank if one sits six feet from the fulcrum and the other eight feet. The heavier boy weighs 120 pounds. How much does the lighter boy weigh?
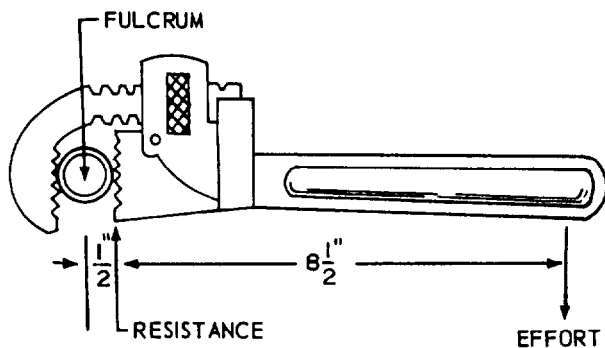
1. 90 lb
2. 106 lb
3. 112 lb
4. 114 lb

Figure 1D

1-16. With the aid of the pipe wrench shown in figure 1D, how many pounds of effort will you need to exert to overcome a resistance of 900 pounds?

1. 25 lb
2. 50 lb
3. 75 lb
4. 100 lb

Questions 1-17 and 1-18 are related to a 300-pound load of firebrick stacked on a wheelbarrow. Assume that the weight of the firebrick is centered at a point and the barrow axle is 1 1/2 feet forward of the point.

1-17. If a Seaman grips the barrow handles at a distance of three feet from the point, how many total pounds will the Seaman have to lift to move the barrow?

1. 65 lb
2. 100 lb
3. 150 lb
4. 300 lb

1-18. If a Seaman grasps the handles 3 1/2 feet from the point where the weight is centered, how many pounds of effort will be exerted?

1. 50 lb
2. 90 lb
3. 100 lb
4. 120 lb

1-19. In lever problems, the length of the effort arm multiplied by the effort is equal to the length of the

1. resistance arm multiplied by the effort
2. resistance arm multiplied by the resistance
3. effort arm multiplied by the resistance arm
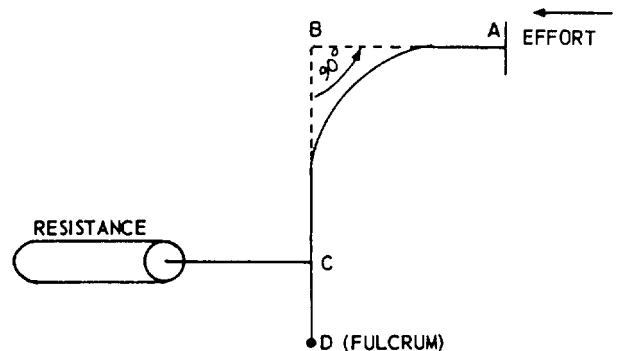4. effort arm multiplied by the resistance

Figure 1E.—A curved lever.

1-20. The length of the effort arm in figure 1E is equal to the length of the

1. curved line from A to C
2. curved line from A to D
3. straight line from B to C
4. straight line from B to D
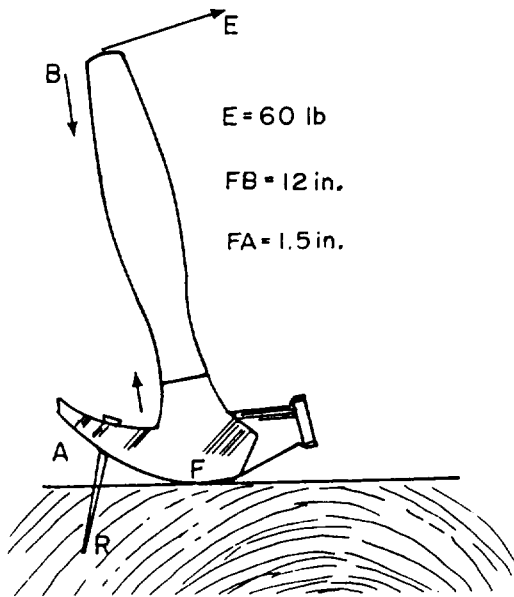
3

E = 60 lb

FB = 12 in.

FA = 1.5 in.

Figure 1F

1-21.   Refer to figure 1F. If a person exerts at point B a pull of 60 pounds on the claw hammer shown, what is the resistance that the nail offers?

1.   60 lb
2.   120 lb
3.   480 lb
4.   730 lb

1-22.   Which of the following definitions describes the mechanical advantage of the lever?

1.   Effort that must be applied to overcome the resistance of an object divided by the resistance of the object
2.   Amount of work obtained from the effort applied
3.   Gain in power obtained by the use of the lever
4.   Resistance offered by an object divided by the effort which must be applied to overcome this resistance

1-23.   The mechanical advantage of levers can be determined by dividing the length of the effort arm by the

1.   distance between the load and the point where effort is applied
2.   distance between the fulcrum and the point where effort is applied
3.   distance between the load and the fulcrum
4.   amount of resistance offered by the object
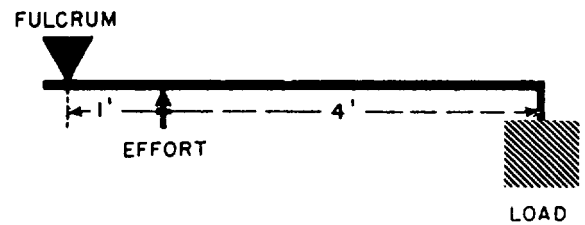

Figure 1G

1-24.   The mechanical advantage of the lever in figure 1G is
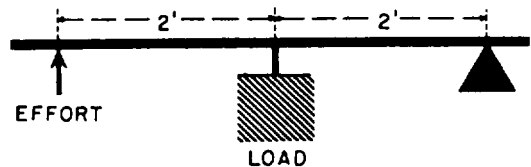
1.   one-fifth
2.   one-fourth
3.   four
4.   five

Figure 1H

1-25.   The mechanical advantage of the lever in figure 1H is

1.   one
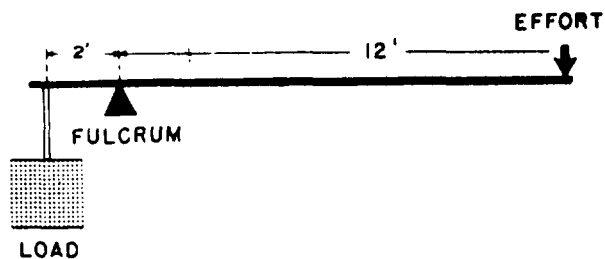2.   two
3.   one-half
4.   one-fourth

4

Figure 1J

1-26. The mechanical advantage of the lever pictured in figure 1J is

1. five
2. six
3. seven
4. one-sixth

1-27. The combination dog and wedge of textbook figure 1-10 is a complex machine since it consists of which two simple machines?

1. Lever and the screw
2. Two first-class levers
3. Lever and the inclined plane
4. One first-class lever and one second-class lever

Information for questions 1-28 and 1-29: The handle of a hatch dog is 9 inches long. The short arm is 3 inches long.

1-28. What is the mechanical advantage of the hatch dog?

1. 12
2. 27
3. 3
4. 9

1-29. With how much force must you push down on the handle to exert 210 pounds force on the end of the short arm?

1. 105 lb
2. 80 lb
3. 70 lb
4. 25 lb

1-30. The rope in a block and tackle is called a

1. runner
2. line
3. fall
4. sheave

1-31. The theoretical mechanical advantage of the single sheave block of textbook figure 2-2 is

1. one
2. two
3. one-half
4. zero

1-32. A single block-and-fall rigged as a runner has a theoretical mechanical advantage of

1. one
2. two
3. one-half
4. four

1-33. In a block and tackle having a mechanical advantage greater than one, how does the distance the load moves compare with the length of the rope which is pulled through the block?

1. It is less
2. It is the same
3. It is greater
4. It depends on the weight of the load

1-34. What advantage can you obtain by replacing the single fixed block of textbook figure 2-3 with the gun tackle purchase of textbook figure 2-6?

1. You can pull the rope from a more convenient position
2. You need to exert about 1/3 as much effort to lift the same load
3. You can lift the same load in 1/2 the time
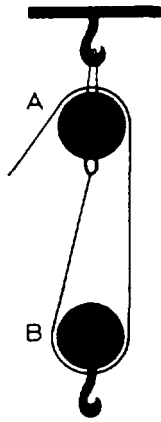4. You need to exert about 1/2 as much effort to lift the same load

Figure 1K

1-35. In the arrangement of figure 1K the
purpose of block A is to

1. increase the mechanical
advantage of the block
2. change the direction of the
applied force
3. hold up block B
4. act as a runner for block B

1-36. A luff tackle is a block and tackle
consisting of a

1. fixed double block and a
movable single block
2. movable double block and a
fixed single block
3. fixed single block and a
movable single block
4. fixed triple block and a
movable double block

Information for questions 1-37 and
1-38: Alone you're going to hoist
a 600-pound load to a height of 36 feet.
You can pull 160 pounds' worth. You have
to use a fixed block fastened to a beam
above you. You have a movable block
attached to the pad eye of the load.

1-37. What minimum mechanical advantage
must the block and tackle provide?

1. One
2. Two
3. Three
4. Four

1-38. For which requirement will it be to
your advantage to rig a yard to a
stay tackle if each tackle has a
theoretical mechanical advantage of
two?

1. A theoretical mechanical
advantage of 4
2. A change in the direction of
pull for convenience
3. A heavy crate to be lifted to
the other side of a low fence
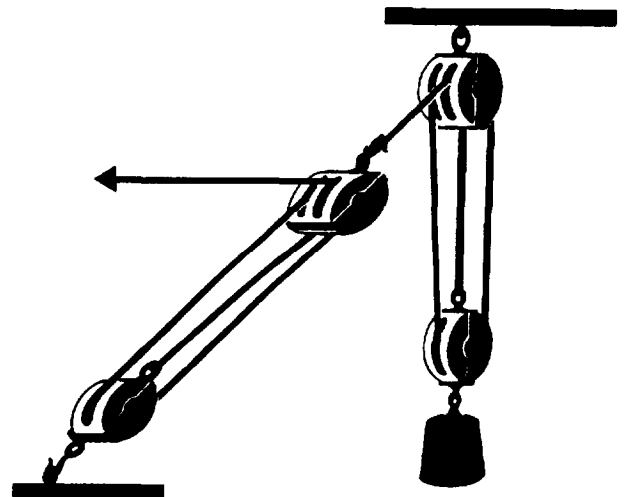4. An increase in speed

Figure 1L

1-39. The overall mechanical advantage in
figure 1L is about

1. five
2. six
3. eight
4. twelve

1-40. You are using a differential pulley
to lift a load of 2,400 pounds.
Fifty pounds of effort are required
to overcome the frictional
resistance of the pulley. What
force is necessary to lift the load
if the theoretical mechanical
advantage of the pulley is 24?

1. 50 lb
2. 100 lb
3. 150 lb
4. 200 lb

1-41. With a block and tackle the effort has to move 125 feet in order to raise a load 25 feet. The friction is so great that it takes a force of 75 pounds to lift a load of 300 pounds. The actual mechanical advantage is
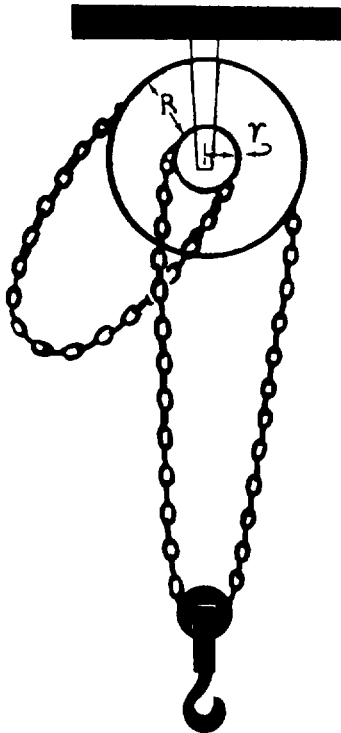
1. five
2. two
3. three
4. four

Figure 1M

1-42. The theoretical mechanical advantage of a differential pulley, such as the one pictured in figure 1M, depends upon the

1. difference in diameters of the two top pulleys
2. sum of diameters of the two top pulleys
3. length of the chain
4. difference in diameters of the two small pulleys

1-43. In the differential pulley pictured in figure 1M, if the radius of the small pulley at the top is 3 inches, the radius of the large pulley at the top is 4 inches, and the radius of the pulley at the bottom is 2 1/2 inches, the theoretical mechanical advantage is

1. 8
2. 9
3. 30
4. 36

1-44. Why is the actual mechanical advantage of the differential pulley of textbook figure 2-11 never so great as the theoretical mechanical advantage of the pulley?

1. Part of the effort applied to the chain is used to overcome the frictional resistance of the pulley's moving parts
2. The diameter of C is between those of A and B
3. The diameter of A is greater than that of B
4. The length of the chain fed down is greater than the length of the chain fed up

1-45. A wheel and axle can rotate clockwise or counterclockwise about an axis to provide a mechanical advantage or an increase in speed.

1. True
2. False

1-46. The mechanical advantage of a wheel and axle depends upon the

1. amount of force applied and the size of the wheel
2. size of the wheel and the amount of the resistance
3. ratio of the radius of the wheel to which force is applied to the radius of the axle on which it turns
4. length of the axle

1-47. What maximum load can you lift by applying a 50-pound force to the handle of an 18-inch crank that is connected to a 9-inch-diameter drum of a hand winch?

1. 50 lb
2. 100 lb
3. 150 lb
4. 200 lb

1-48. The moment resulting from a force acting on a wheel and axle is equal to the

1. amount of force required to produce equilibrium in a wheel and axle
2. ratio of the force to the distance from the center of rotation
3. distance from the point where the force is applied to the center of the axle
4. product of the amount of the force and the distance of the force from the center of rotation
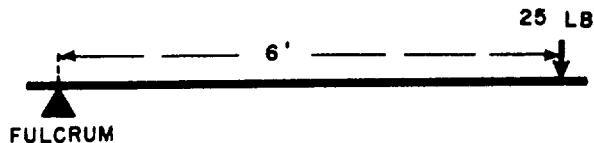
Figure 1N

1-49. The clockwise moment of force about the fulcrum of figure 1N is

1. 4 2/3 ft-lb
2. 6 ft-lb
3. 25 ft-lb
4. 150 ft-lb

1-50. If in the lever shown in figure 1N both the amount of force and the distance between the fulcrum and the point where force is applied are doubled, the torque will be

1. 1/2 as great as before the changes were made
2. 2 times as great as before the changes were made
3. 4 times as great as before the changes were made
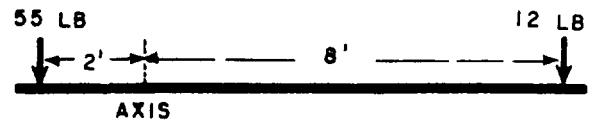4. 8 times as great as before the changes were made

Figure 1P

1-51. What would be the resultant torque in figure 1P?

1. Clockwise torque of 10 ft-lb
2. Clockwise torque of 14 ft-lb
3. Counterclockwise torque of 10 ft-lb
4. Counterclockwise torque of 14 ft-lb

1-52. What will happen to a machine when clockwise and counterclockwise moments of force are in balance?

1. The machine will break down
2. The machine will either remain at rest or move at a steady speed
3. The machine will move at an increasing speed
4. The machine will move at a decreasing speed
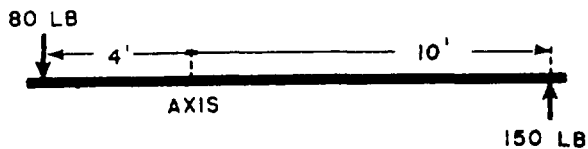
8

Figure 1Q

1-53. The result of forces acting as shown in figure 1Q would be a torque of

1. 600 ft-lb
2. 1,180 ft-lb
3. 1,820 ft-lb
4. 2,680 ft-lb

Information to answer questions 1-54 through 1-56: The service manual for an engine states that a certain nut is to be tightened by a moment of 90 foot-pounds.

1-54. If a wrench 18 inches long is used, the amount of force that should be exerted at the end of the wrench is

1. 5 lb
2. 9 lb
3. 60 lb
4. 162 lb

1-55. How many pounds of effort could be saved by using a two-foot long wrench?

1. 15 lb
2. 30 lb
3. 45 lb
4. 50 lb

1-56. What kind of wrench could you use that measures directly the amount of force you are exerting on the nut?

1. Pipe wrench
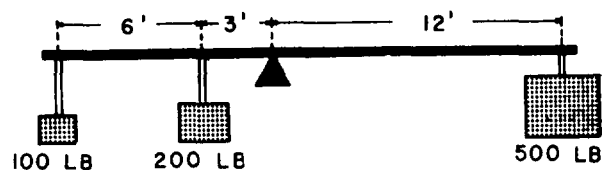2. Torque wrench
3. Spanner wrench
4. Adjustable end wrench

Figure 1R

1-57. The result of forces operating as shown in figure 1R is equivalent to a moment of

1. 300 ft-lb in a clockwise direction
2. 700 ft-lb in a counterclockwise direction
3. 4,500 ft-lb in a clockwise direction
4. 6,000 ft-lb in a counterclockwise direction

When answering questions 1-58 through 1-60, refer to figure 1S.
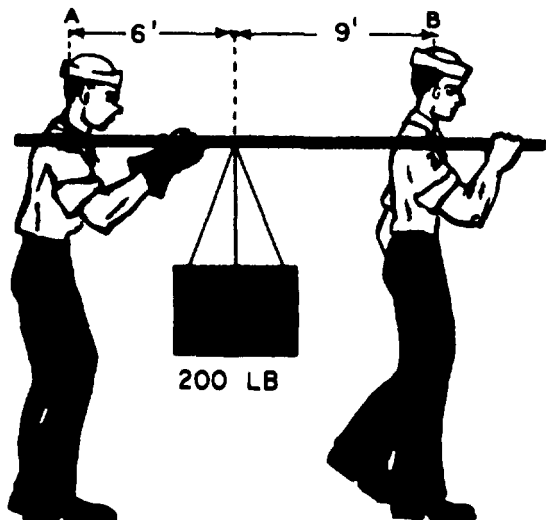

Figure 1S

1-58. The clockwise moment about A is

1. 200 ft-lb
2. 300 ft-lb
3. 1,200 ft-lb
4. 1,800 ft-lb

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1-59. The counterclockwise moment about B is

1. 200 ft-lb
2. 1,200 ft-lb
3. 1,800 ft-lb
4. 3,000 ft-lb

1-60. How much of the load is the sailor at the right carrying?

1. 22 2/9 lb
2. 33 1/3 lb
3. 80 lb
4. 120 lb

1-61. The sailor in figure 3-4 in your textbook can increase his effectiveness without exerting a greater effort by using a shorter capstan bar.
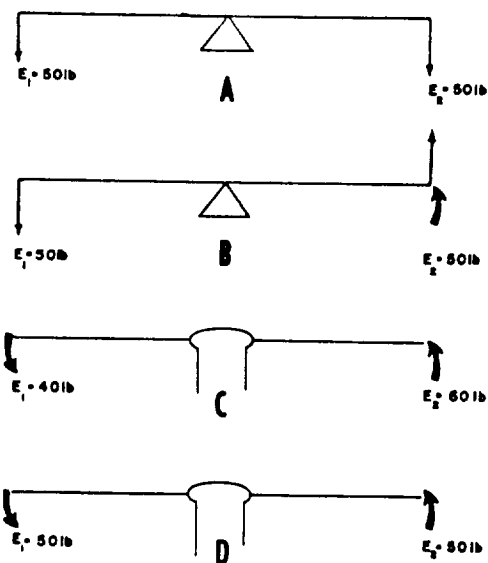
1. True
2. False

Figure 1T

1-62. Which of the parts of figure 1T represents the wheel and axle arrangement known as a couple?

1. A
2. B
3. C
4. D

1-63. A ship's deck is 24 feet above the dock. How long a gangplank is needed to provide a theoretical mechanical advantage of 2?

1. 24 ft
2. 48 ft
3. 60 ft
4. 96 ft

1-64. A sailor is rolling a 400-pound barrel up a 20-foot long ramp to a 3-foot height. Neglecting friction, the force needed to move the barrel up the ramp is

1. 60 lb
2. 133 1/3 lb
3. 200 lb
4. 220 lb

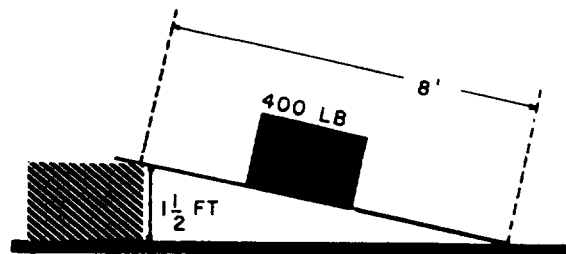When answering questions 1-65 through 1-68, refer to figure 1U.

Figure 1U

1-65. The theoretical mechanical advantage of the inclined plane is

1. 3/16
2. 3
3. 5 1/3
4. 6

1-66. Neglecting friction, the force, needed to pull the crate up the inclined plane is

1. 50 lb
2. 75 lb
3. 124 lb
4. 600 lb

1-67. If a force of 133 pounds is actually required to move the crate up the inclined plane, the amount of force expended in overcoming friction is

1. 20 lb
2. 33 lb
3. 58 lb
4. 66 lb

1-68. Since a force of 133 pounds was exerted in moving the crate up the inclined plane, the actual mechanical advantage is

1. 1/3
2. 2 1/3
3. 3
4. 4

1-69. A 3,000-pound automobile is towed up a ramp 150 feet long running from the street floor to the second floor of a garage. The towing force required was 300 pounds. What is the distance between floors if 20 pounds of force were needed to overcome frictional resistance?

1. 8.6 ft
2. 10 ft
3. 14 ft
4. 15 ft

Information for questions 1-70 and 1-71: By exerting an effort of 115 pounds, you move a 300-pound crate up an inclined plane 12 feet long to a truck bed three feet above the sidewalk.

1-70. What is the theoretical mechanical advantage of the inclined plane?

1. One
2. Two
3. Three
4. Four

1-71. How much of your effort is used to overcome friction?

1. 35 lb
2. 40 lb
3. 75 lb
4. 115 lb

1-72. What is the characteristic shape of wedges which have a high mechanical advantage?

1. Short and thick
2. Long and thin
3. Long and thick
4. Short and thin

1-73. If a wedge is 6 inches long, 3 inches wide, and 1 1/2 inches thick at the top, the theoretical mechanical advantage is

1. 1 1/2
2. 2
3. 3
4. 4

1-74. A member of a damage control party uses a maul to drive a wedge in behind a shore to tighten up a damaged bulkhead. The wedge is 15 inches long and 3 inches thick at the butt. How many pounds of force will be delivered against the face of the wedge by an 80-pound blow on the wedge butt with the maul?

1. 80 lb
2. 240 lb
3. 400 lb
4. 1,200 lb

1-75. A 60-pound blow delivered against the 3/4-inch-thick butt end of a wedge results in an effective splitting force of 480 pounds. How long is the wedge?

1. 3 in
2. 4 in
3. 6 in
4. 8 in

ASSIGNMENT 2

Textbook Assignment: "The Screw," chapter 5, pages 5-1 through 5-4; "Gears," chapter 6, pages 6-1 through 6-8; "Work," chapter 7, pages 7-1 through 7-6; and "Power," chapter 8, pages 8-1 through 8-4.
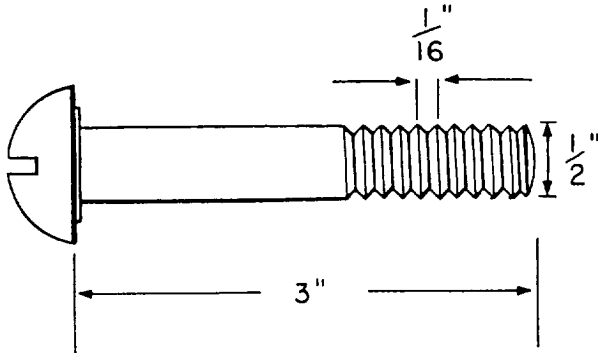

Figure 2A

2-1.   What is the pitch of the screw in figure 2A?

    1.   1/16 in
    2.   1/2 in
    3. 1 4/7 in
    4. 3   in

2-2.   Upon which measurements does the theoretical mechanical advantage of a jackscrew depend?

    1. Pitch and length of the screw
    2. Length of the jack handle and radius of the screw
    3. Pitch and radius of the screw
    4. Length of the jack handle and pitch of the screw

2-3.   How do you find the theoretical mechanical advantage of a jackscrew?

    1. Divide the amount of resistance by the amount of effort required to overcome the resistance
    2. Multiply the length of the jack handle by the radius of the screw and then divide by the length of the screw
    3. Multiply the length of the jack handle by 2π and then divide by the pitch of the screw
    4. Divide the length of the jack handle by 2π and then multiply by the pitch of the screw

2-4.   High friction losses are built into a jackscrew in order to prevent the

    1. screw from turning under the weight of a load as soon as the lifting force is removed
    2. screw from becoming overheated when a load is being lifted
    3. threads of the screw from being sheared off by the weight of a load
    4. jack from toppling over as soon as the lifting force is removed

2-5.   If a screw has a pitch of 1/16 inch, how many turns are required to advance it 1/2 inch?

    1.   2
    2.   8
    3. 16
    4. 32

2–6. If the handle of a jackscrew is turned 16 complete revolutions to raise the jack 2 inches, the pitch of the screw is

1. 1/32 in
2. 1/16 in
3. 1/8 in
4. 1/4 in

2-7. You are pulling a 21-inch lever to turn a jackscrew having a pitch of 3/16 inch. The theoretical mechanical advantage of the jackscrew is about

1. 1,000
2. 700
3. 400
4. 100

2-8. A jackscrew has a handle 35 inches long and a pitch of 7/32 inch. If a pull of 15 pounds is required at the end of the handle to lift a 3,000-pound load, the force expended in overcoming friction is

1. 12 lb
2. 9 lb
3. 3 lb
4. 5 lb

2-9. Refer to textbook figure 5-3. How many complete turns of the thimble are required to increase the opening of the micrometer by 1/4 inch?

1. 25
2. 10
3. 5
4. 4

When answering items 2-10 and 2-11, refer to textbook figure 5-4.

2-10. If the micrometer's thimble is turned exactly five complete revolutions, the new reading is

1. 0.753 in
2. 0.703 in
3. 0.628 in
4. 0.517 in

2-11. Assume that the graduation mark 5 on the thimble is opposite point X. How much farther do you open the micrometer in turning the thimble until the graduation mark 15 is opposite the point for the first time?

1. 0.125 in
2. 0.010 in
3. 0.0125 in
4. 0.0010 in

2-12. How do you find the actual mechanical advantage that a jackscrew provides in lifting a load?

1. Multiply the length of the jack handle by the radius of the screw and then divide by the pitch of the screw
2. Divide the load by the amount of effort required to lift the load
3. Multiply the length of the jack handle by 2 and then divide by the pitch of the screw
4. Divide the distance the screw travels by the number of turns it makes and then subtract the amount of frictional resistance

2-13. If a jackscrew has a pitch of 5/32 inch, the length of the handle required to obtain a theoretical mechanical advantage of 800 is about

1. 30 in
2. 25 in
3. 20 in
4. 15 in

2-14. If a jackscrew requires a force of 15 pounds at the end of the handle to lift a 3,000 pound load, its actual mechanical advantage is

1. 4,500
2. 2,000
3. 450
4. 200

2-15. Which of the following describes the cut of the threads in a screw gear?

1. One end has left-hand threads and the other has right-hand threads
2. Both ends have left-hand threads
3. Both ends have right-hand threads
4. One end has a greater pitch and less depth than the other

2-16. Two Seamen are using a quadrant davit to put a large lifeboat over the side. If the operating handle is released while the boat is being lowered, the boat is kept from falling by means of

1. a friction brake on the operating handle
2. a davit arm and swivel
3. a counterweight
4. self-locking threads on the screw

2-17. Gears serve all of the following purposes EXCEPT

1. eliminating frictional losses
2. changing the direction of motion
3. increasing or decreasing the applied force
4. increasing or decreasing the speed of the applied motion

2-18. What condition must hold true if two gears are to mesh properly?

1. The teeth of both gears must be the same size
2. Both gears must have the same diameter
3. The teeth must be cut slanting across the working faces of the gears
4. The gears must turn on parallel shafts

2-19. Herringbone gears are sometimes used instead of single helical gears in order to

1. change the direction of motion
2. increase the mechanical advantage
3. increase the gear ratio
4. prevent axial thrust on the shaft

2-20. If you should find it necessary to transmit circular motion from a shaft to a second shaft, which is at right angles to the first shaft, which of the following gear arrangements should you use?

1. Internal and pinion gears
2. Miter gears
3. Spur gears and idler
4. Rack and pinion gears

2-21. In a worm and spur gear arrangement, the worm gear is single-threaded and has six threads, and the spur gear has 30 teeth. In order to turn the spur gear one complete revolution, the worm gear must be given how many complete turns?

1.   5
2.   30
3.   50
4. 180

2-22. If the worm gear in the worm and spur gear arrangement in question 2-21 were triple-threaded, the number of times the worm gear would have to be turned in order to produce one complete revolution of the spur gear would be

1.   3 times
2.   10 times
3.   15 times
4.   60 times

2-23. You have a pinion gear with 14 teeth driving a spur gear with 42 teeth. If the pinion turns at 420 rpm, what will be the speed of the spur gear?

1. 42 rpm
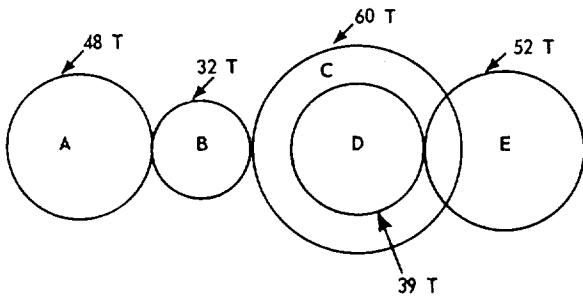2. 140 rpm
3. 160 rpm
4. 278 rpm

Figure 2B

For items 2-24 through 2-28, refer to the gear system in figure 2B and to the symbols which follow.

Gears C and D are rigidly attached to one another.

S_a = speed of gear A
S_b = speed of gear B
S_c = speed of gear C
S_d = speed of gear D
S_e = speed of gear E
A = number of teeth on gear A
B = number of teeth on gear A
C = number of teeth on gear C
D = number of teeth on gear D
E = number of teeth on gear E

2-24. Given S_a, A, and B, a formula for testing S_b is

1. $S_a/S_b = A/B$
2. $S_b/S_a = A/B$
3. $S_a S_b = AB$
4. $S_b = B/A - S_a$

2-25. Given S_a, A, B, C, D, and E, a formula for finding S_e is

1. $S_e = S_a \dfrac{(ABD)}{(BCE)}$

2. $S_e = S_a \dfrac{(ABE)}{(CDE)}$

3. $S_e/S_a = E/A$

2-26. Gear A would make how many revolutions for every complete revolution of gear C?

1. 4/5
2. 1 1/5
3. 1 1/4
4. 1 1/2

2-27. Which formula is used for finding the mechanical advantage of the system of gears including only gears B, C, D, and E, assuming that power is applied to gear B?

1. $\dfrac{C}{B} \times \dfrac{E}{D}$

2. $\dfrac{B}{C} \times \dfrac{D}{E}$

3. $\dfrac{C}{B} + \dfrac{E}{D}$

4. $\dfrac{B}{C} + \dfrac{D}{E}$

2-28. Assuming that power is applied to gear A, the entire gear train will have a mechanical advantage of
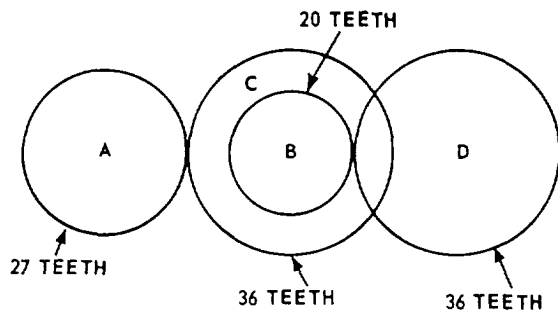
1. 0.67
2. 1.67
3. 3.34
4. 6.68

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Figure 2C

2-29. Gears B and C in the gear arrangement shown in figure 2C are rigidly fixed together. If gear A is turned counterclockwise at a rate of 120 rpm, in what direction and at what rate will gear D turn?

1. Clockwise at 20 rpm
2. Clockwise at 50 rpm
3. counterclockwise at 50 rpm
4. Counterclockwise at 100 rpm

2-30. The product of all the driving teeth of a turbine reduction gearing is 400 and the product of the driven teeth is 4,000. When the output shaft turns at 200 rpm, the turbine turns at

1. 200 rpm
2. 400 rpm
3. 2,000 rpm
4. 4,000 rpm
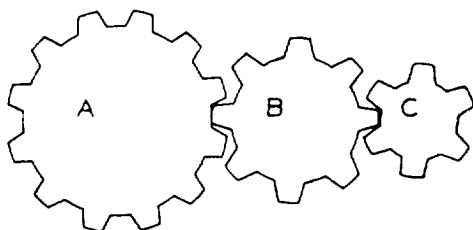
Figure 2D

2-31. The speed ratio of the gear train in figure 2D is 2 to 1. If gear B is removed and gear C is placed so that it runs directly off gear A. the speed ratio will be

1. 2.0 to 1
2. 2.4 to 1
3. 3.0 to 1
4. 4.0 to 1

2-32. The purpose of an idler gear is to

1. increase the speed ratio
2. take up lost motion
3. change the direction of rotation
4. keep another gear in place
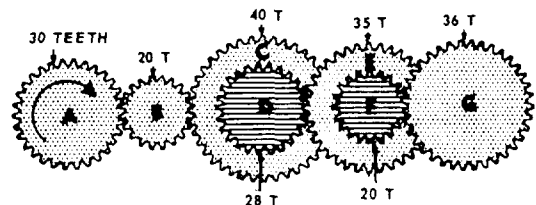
Figure 2E

Items 2-33 through 2-36 are based on the gear train shown in figure 2E.

2-33. Which gear serves as an idler gear?

1. D
2. C
3. B
4. A

2-34. If gear A turns at 300 rpm, how fast does gear G turn?

1. 180 rpm
2. 100 rpm
3. 87 rpm
4. 80 rpm

2-35. What is the mechanical advantage of the train?

1. Five
2. Two
3. Three
4. Four

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2-36. The direction of rotation of gear G is counterclockwise.

1. True
2. False

Use the following information to compute the mechanical advantage of textbook figure 6-1: Gear A radius = 2 inches; Gear A teeth = 36; Gear B and C teeth = 8; handle turn radius = 1 1/2 inches.

2-37. The mechanical advantage of the eggbeater is

1. 1/8
2. 1/6
3. 1/4
4. 1/2

2-38. Refer to textbook figure 6-3B. What is the function of this gear arrangement if the pinion is driving the internal gear?

1. To increase speed
2. To magnify force
3. To change direction of motion
4. To change rotary motion into linear motion

2-39. Refer to the left-hand half of figure 6-12 in your textbook. Which of the following statements best describes the action of the valve as the camshaft rotates 180° from its position as shown in the figure?

1. The valve remains closed
2. The valve opens and stays open
3. The valve opens and then closes
4. The valve opens and closes twice

2-40. A foot-pound is defined as the amount of

1. force developed by a one-pound weight falling a distance of one foot
2. energy required to lift a one-pound weight
3. power required to overcome a resistance of one pound
4. work required to overcome a resistance of one pound through a distance of one foot

2-41. Which of the following is an example of work?

1. Holding two pieces of glued wood in a vise
2. Rolling a barrel up a gangplank
3. Changing water to steam
4. Burning a log in a fireplace

2-42. When you calculate the amount of work you have done on an object, the factors which you must always measure are the

1. resistance encountered and the distance it is moved
2. weight of the object and the distance it is moved
3. angle at which force is applied and weight of the object
4. time required to move the object and resistance encountered

2-43. Assume that you must apply a force of 150 pounds to overcome the resistance of a crate weighing 350 pounds. In moving the crate up an inclined plane which is 12 feet long, how much work do you do?

1. 4,200 ft-lb
2. 1,800 ft-lb
3. 350 ft-lb
4. 150 ft-lb

Information for items 2-44 through 2-46: You are using a first-class lever to raise a 400-pound load to a height of 1 foot. The effort arm of your lever is 8 feet long and the resistance arm is 2 feet long.

2-44. How much work is done in raising the load?

1. 400 ft-lb
2. 300 ft-lb
3. 200 ft-lb
4. 50 ft-lb

2-45. How far must you move the lever in order to raise the load 1 foot?

1. 1 ft
2. 2 ft
3. 8 ft
4. 4 ft

2-46. How much work is done in balancing the load at the 1-foot height?

1. 0 ft-lb
2. 2 ft-lb
3. 8 ft-lb
4. 10 ft-lb

2-47. By using a machine to move an object you can

1. decrease the amount of work to be done
2. reduce the weight of the object
3. decrease the amount of the effort required
4. reduce the resistance of the object

Information for questions 2-48 through 2-51: You are using a 24,000-pound load with a screwjack that has a pitch of 1/4 inch and a 24-inch handle.

2-48. Theoretically, (by neglecting friction), you should be able to turn the jack handle by exerting an effort of about

1. 24 lb
2. 40 lb
3. 60 lb
4. 80 lb

2-49. Because of friction. you actually have to apply a 120-pound force to turn the jack handle. About how much work do you do in turning the handle one complete revolution?

1. 120 ft-lb
2. 240 ft-lb
3. 1,500 ft-lb
4. 3,000 ft-lb

2-50. With each revolution of the jack handle, the work output of the jack equals

1. 100 ft-lb
2. 200 ft-lb
3. 500 ft-lb
4. 600 ft-lb

2-51. The efficiency of the jack is

1. 12 1/2%
2. 33 1/3%
3. 50 %
4. 66 2/3%

Information for questions 2-52 through 2-54: You push with a force of 125 pounds to slide a 250-pound crate up a gangplank. The gangplank is 12 feet long and the upper end is 5 feet above the lower end.

2-52. What is the theoretical mechanical advantage of the gangplank?

1. 1
2. 2
3. 2.4
4. 12

2-53. How much of your 125-pound push is used to overcome friction?

1. 21 lb
2. 42 lb
3. 62 1/2 lb
4. 125 lb

2-54. What is the efficiency of the gangplank?

1. 25%
2. 50%
3. 75%
4. 83.3%

Information for questions 2-55 and 2-56: You want to raise an 1,800-pound motor 4 feet up to a foundation. You use two double-sheave blocks rigged to give a mechanical advantage of 4 and a windlass that has a theoretical mechanical advantage of 6.

2-55. Assuming 100 percent efficiency, how much work is required to raise the motor?

1. 1,800 ft-lb
2. 3,600 ft-lb
3. 7,200 ft-lb
4. 10,800 ft-lb

2-56. Neglecting friction, how much pull must you exert to raise the motor?

1. 18 lb
2. 36 lb
3. 75 lb
4. 300 lb

2-57. An effect which friction has on the mechanical advantage of any machine is to make the

1. theoretical mechanical advantage less than the actual mechanical advantage
2. actual mechanical advantage less than the theoretical mechanical advantage
3. actual mechanical advantage less than one
4. actual mechanical advantage more than one

2-58. Assume that the hammer of a pile driver weighs 1,000 pounds. The resistance of the earth is 6,000 pounds. If the hammer drops 4 feet to drive a pile, how far into the earth will the pile be driven? (Assume an efficiency of 100%.)

1. 2 in
2. 6 in
3. 8 in
4. 10 in

When answering questions 2-59 through 2-61, assume that a man lifts a 600-pound load, using a block and tackle with a theoretical mechanical advantage of 6. He does 6,500 foot-pounds of work in lifting the load 8 feet.

2-59. How much work does the man do in overcoming friction?

1. 215 ft-lb
2. 813 ft-lb
3. 1,700 ft-lb
4. 5,900 ft-lb

2-60. The total force exerted by the man in lifting the load is approximately

1. 35 lb
2. 135 lb
3. 215 lb
4. 406 lb

2-61. The average amount of force which the man exerted to overcome friction is approximately

1. 35 lb
2. 215 lb
3. 237 lb
4. 406 lb

2-62. The handle of a screwjack must move through a circular distance of 600 inches to lift a load one inch. If a force of 10 pounds is required to lift a load of 1,500 pounds, what is the efficiency of the jack?

1. 25%
2. 33%
3. 78%
4. 90%

2-63. A block and tackle has a theoretical mechanical advantage of 4 but requires a force of 50 pounds to lift a 160-pound load. The efficiency of the block and tackle is

1. 60%
2. 70%
3. 80%
4. 90%

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2-64. In a certain machine, the effort moves 20 feet for every foot that the resistance moves. If the machine is 75 percent efficient, the force required to overcome a resistance of 300 pounds is

1. 15 lb
2. 20 lb
3. 25 lb
4. 30 lb

2-65. If a block and tackle has a theoretical mechanical advantage of 5 and an efficiency of 60 percent, the amount of force necessary to lift a 1,200-pound load is

1. 30 lb
2. 150 lb
3. 400 lb
4. 720 lb

2-66. Which of the following statements concerning the relationship of work output and work input of a machine is correct?

1. The output is the same as the input
2. The output is greater than the input
3. The output is less than the input
4. The output has no relationship to the input

2-67. The amount of work done divided by the time required is called

1. energy
2. resistance
3. force
4. power

⬤   When answering questions 2-68 through 2-73, assume 100 percent efficiency in each situation and use the appropriate power formula to calculate the unknown quantity.

2-68. A motor-driven hoist lifts a 165-pound load to a height of 50 feet in 30 seconds. How much power does the motor develop?

1. 1/4 hp
2. 1/2 hp
3. 3 hp
4. 10 hp

2-69. A power winch is capable of lifting a 440-pound load a distance of 5 feet in 1 second. The driving motor works at the rate of

1. 1/2 hp
2. 1 hp
3. 2 hp
4. 4 hp

2-70. What is the horsepower of the engine driving the pump that lifts 9,900,000 pounds of water per day from a lake to the top of a standpipe, a vertical distance of 120 feet? The engine runs at a uniform speed 12 hours a day.

1. 12 hp
2. 15 hp
3. 24 hp
4. 50 hp

2-71. While a propeller-driven aircraft travels at a speed of 120 mph, its engine develops 1,500 hp. Approximately what force in pounds is being exerted by the propeller?

1. 850 lb
2. 5,000 lb
3. 15,000 lb
4. 30,000 lb

2-72. What is the horsepower of a hoisting engine that can raise 6,000 pounds through a height of 44 feet in one minute?

1. 3 hp
2. 4 hp
3. 8 hp
4. 12 hp

2-73. An annunition hoist is powered by a 2-hp motor. Working at full load, how long does it take the motor to raise a 50-pound shell 22 feet from the handling room to the gun turret?

1. 1/2   sec
2. 1   sec
3. 1 1/2 sec
4. 2   sec

2-74. If it is desired to develop ten usable horsepower from an engine which is 50 percent efficient, the engine must have a minimum rated horsepower of at least

1. 10
2. 20
3. 100
4. 150

2-75. What information is sufficient to find the horsepower rating of a motor by means of the Prony brake in figure 8-3 of the textbook?

1. The readings on both scales, the radius of the pulley, and the time it takes the motor to reach maximum speed
2. Tile readings on both scales. the radius of the pulley, and the speed of the motor
3. The readings on both scales, the radius of the pulley, and the diameter of the motor shaft.
4. The radius of the pulley and the readings on the scales when the belt is pulled tight enough to prevent the motor from turning

ASSIGNMENT 3

Textbook Assignment: "Force and Pressure," chapter 9, pages 9-1 through 9-7; "Hydrostatic and Hydraulic Machines," chapter 10, pages 10-1 through 10-10; and "Machine Elements and Basic Mechanisms," chapter 11, pages 11-1 through 11-15.

3-1. With which of the following devices is force measured?

1. A manometer
2. A bourdon gauge
3. A spring scale
4. A barometer

3-2. Pressure is expressed in terms of

1. distance and density
2. volume and force
3. density and volume
4. area and force

3-3. If a cylindrical tank which stands on end is 4 feet in diameter and contains 350 pounds of water, the pressure on the bottom of the tank is approximately

1. 22 lb per sq ft
2. 28 lb per sq ft
3. 65 lb per sq ft
4. 350 lb per sq ft

3-4. At sea level, what is the force of the atmosphere on each side of a cube measuring 16 inches on a side?

1. 380 lb
2. 890 lb
3. 2,400 lb
4. 3,840 lb

3-5. If the pressure in a steam boiler that supplies pressure to a piston 4 inches in diameter is 600 pounds per square inch, the total force exerted on the piston is approximately

1. 150 lb
2. 600 lb
3. 2,400 lb
4. 7,500 lb

3-6. The airbrake cylinder on a railroad car has a diameter of 8 inches. The locomotive supplies compressed air to this cylinder at 90 pounds pressure per square inch. How much force is transmitted to the brake shoes when the brakes are applied?

1. 720 lb
2. 4,520 lb
3. 5,000 lb
4. 6,500 lb

3-7. When the pressure being measured with the gauge shown in textbook figure 9-4 is decreased, the linkage end of the Bourdon tube has a tendency to move so as to cause the

1. tube to become less curved
2. tube to become more curved
3. pointer to turn clockwise
4. pointer and gear to turn in opposite directions

3-8. In which of the following situations would a Schrader gauge be used instead of a Bourdon gauge or diaphragm gauge?

1. Measuring the force that air exerts on an object at sea level
2. Measuring pressure in a hydraulic system in which the load fluctuates rapidly
3. Measuring the force that water exerts on an object at the bottom of a tank
4. Measuring air pressure in the space between inner and outer boiler casings

3-9. What instrument is best for measuring pressure differences in an atmosphere of air where the pressure ranges between 31 and 32 inches of mercury?

1. Bourdon gauge
2. Schrader gauge
3. Manometer
4. Diaphragm gauge

3-10. A barometer is used to measure

1. absolute temperature
2. atmospheric pressure
3. relative humidity
4. steam pressure

3-11. The forces in an aneroid barometer that balance each other are the

1. resistance of a metal box to stretching or compression plus the tension in a spring and atmospheric pressure
2. resistance of a metal box to stretching or compression plus the force exerted by the air in the box, and the force exerted by the atmosphere
3. force exerted by steam under pressure and the tension in a spring
4. force resulting from expansion in a metal bar and the tension in a spring

3-12. The forces in a mercurial barometer which balance each other are the

1. weight of a column of mercury plus the force exerted by the air in the tube above the mercury, and the force exerted by the atmosphere plus 14.7 psi
2. force exerted by steam under pressure and the force exerted by the weight of a column of mercury
3. forces exerted by the atmosphere and the weight of a column of mercury
4. weight of a column of mercury, and the pressure of the vacuum above the mercury plus the force exerted by the atmosphere

3-13. If an airtight container is filled with steam and then cooled so that the steam condenses, the pressure inside the container is reduced because

1. a volume of steam weighs less than an equal volume of water
2. the pressure on the surface of a liquid is always zero
3. the water resulting from the condensation of the steam cannot be compressed
4. a partial vacuum results from the condensation of the steam

3-14. Which of the following instruments is used for measuring pressures in the condenser for a steam turbine?

1. Barometer
2. Schrader gauge
3. Manometer
4. Bourdon tube gauge

Information for items 3-15 and 3-16: Pressure measurements are generally classified as absolute pressure or gauge pressure. Absolute pressure is the total pressure, including that of the atmosphere; it is the pressure measured above zero pressure as a reference level. Gauge pressure is the difference between absolute pressure and the pressure of the atmosphere; it is pressure measured above atmospheric pressure as a reference level.

3-15. At sea level, the pressure in a tire is 24 psi gauge pressure. The absolute pressure in the tire is approximately

1. 39 psi
2. 33 psi
3. 24 psi
4. 9 psi

3-16. At sea level, the pressure in an air tank as measured by an aneroid barometer is 31 inches of mercury. How much greater or less than atmospheric pressure is the pressure in the air tank?

1. 1 inch more
2. 1 inch less
3. 2 inches less
4. 2 inches more

3-17. A manometer is an example of forces in equilibrium. The forces that balance each other are the

1. force exerted by the atmosphere and the force exerted by the liquid inside the closed container
2. force exerted by the gas inside the closed container plus the weight of the liquid on one side of the tube, and the force exerted by the atmosphere plus the weight of the liquid in the other side of the tube
3. force exerted by the steam in the steam line and the weight of a column of liquid
4. force exerted by the gas inside the closed container and the weight of part of the liquid in the tube

3-18. What instruments are interchangeable as pressure-measuring devices?

1. Aneroid barometer and mercurial barometer
2. Schrader gauge and manometer
3. Spring scale and steel yard
4. Bourdon gauge and diaphragm-type pressure gauge

3-19. Hydrostatic pressure is the pressure exerted by

1. gas in motion
2. gas at rest
3. liquid at rest
4. liquid in motion

3-20. Density is defined in terms of

1. pressure and volume
2. weight and distance
3. pressure and area
4. weight and volume
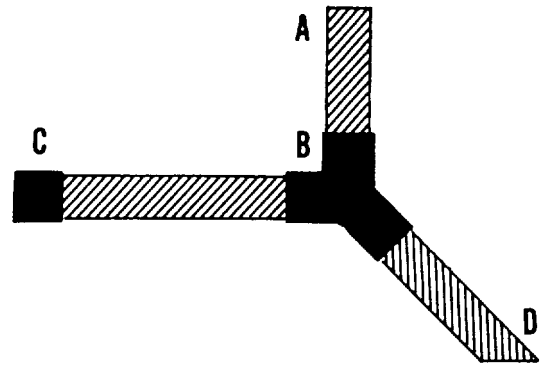
Figure 3A

3-21. The pipes in figure 3A are filled with water. Pipe AB is vertical; pipe CB is horizontal; pipe ED points downward at an angle. The point of greatest pressure is at point

1. A
2. B
3. C
4. D

3-22. The density of lead is approximately how many times greater than the density of water?

1. 5
2. 7
3. 9
4. 11

3-23. Which of the following is a true statement concerning the pressure of water on a submerged submarine?

1. The pressure is equal on the top and on the bottom
2. The pressure is greater on the top than on the bottom
3. The pressure is greater on the bottom than on the top
4. There is pressure only on the top

3-24. If one cubic foot of substance A weighs more than one cubic foot of substance B, what is the relationship between the densities of substances A and B?

1. The density of substance A is greater than the density of substance B
2. The density of substance A is less than the density of substance B
3. The density of substance A is the same as the density of substance B
4. Not enough information is given to determine the relationship

3-25. Depth charges are dropped in the vicinity of a submerged submarine. The depth charge illustrated in textbook figure 10-1 is set so as to be exploded by the

1. speed of the depth charge as it nears the submarine
2. speed of the depth charge as it enters the water
3. impact of the depth charge against the hull of the submarine
4. pressure of the water at the estimated depth of the submarine

3-26. Hydrostatic pressure in a torpedo is employed to

1. maintain the torpedo on course
2. launch the torpedo
3. keep the torpedo at desired depth
4. increase the torpedo speed

3-27. In a torpedo depth engine, the setting of the depth screw determines the

1. pressure of the air supplied to the depth engine
2. length of the pendulum
3. angular set of the vertical rudders
4. amount of force which is required to move the diaphragm

3-28. The air pumped into a diver's suit helps him or her to withstand the pressure of the water because

1. pressure of the air in the diver's suit is greater than the pressure of the water
2. air enters the diver's body so that the pressure inside his or her body is equal to the water pressure
3. air is compressible and water is not
4. force is not transmitted by air

3-29. The pressure in a diver's suit must be released gradually because

1. if pressure is released too rapidly, the air which entered the diver's body under high pressure will cause bubbles to form in his or her blood stream
2. the diver's lungs cannot quickly become adjusted to breathing air at normal pressure
3. the diver's blood circulation was partly cut off while under high pressure, and sudden return of normal circulation is painful
4. air at normal pressure contains less oxygen than air at high pressure, and the body must adjust to this condition gradually

3-30. The pitometer log determines the speed of a ship by measuring the difference between

1. hydrostatic pressure near the keel of the ship and hydrostatic pressure near the water line
2. hydrostatic pressure and the pressure of water in motion past the ship at the same depth
3. pressure of the water moving past the ship and atmospheric pressure
4. pressure of the water moving past the ship and the speed of surface wind

3-31. The speed of a ship can be determined from a pitometer log by

1. multiplying the reading on the pitometer log by a constant factor which is dependent upon the characteristics of the ship
2. combining the reading of the pitometer log with the reading of the engine revolution counter
3. dividing the reading by the density of the water
4. reading it directly from the calibrated scale

3-32. A hydraulic machine is one which operates as a result of forces transmitted by

1. mechanical energy
2. electrical energy
3. steam in a closed space
4. liquid in a closed space

3-33. A closed hydraulic system will not operate properly if air is present in the lines or cylinders because

1. air is highly compressible and cannot be used to transmit forces
2. air, being compressible, would not transmit the applied pressure
3. air interferes with the proper operation of the valves
4. air increases the pressure in both cylinders

3-34. Which of the following is NOT a true statement concerning transmission of pressure in a liquid in a closed space?

1. Pressure applied to any part of the liquid is transmitted equally to all points in the liquid
2. Pressure applied to any part of the liquid is transmitted to all points in the liquid without loss
3. Pressure in the liquid causes it to expand and increase in density
4. Pressure in the liquid acts at right angles to the walls of the container regardless of the shape of the container

3-35. Which of the following has NO relationship to the mechanical advantage of a hydraulic machine with one small and one large piston?

1. The area of the small piston
2. The area of the large piston
3. The length of the connecting tube
4. The distances the two pistons move
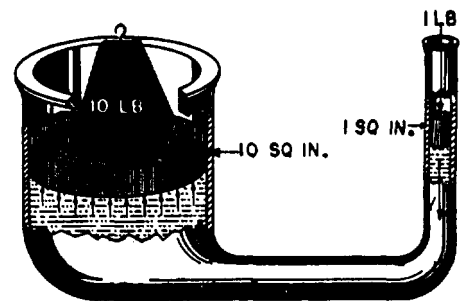
Figure 3B

Items 3-36 through 3-38 are related to figure 3B.

3-36. If the weight on the large piston just balances the weight on the small piston, it follows that the

1. force per unit of area is the same on both pistons
2. weights on the two pistons are equal
3. force on the large piston equals that on the small piston
4. pressure is greater below the small piston than it is below the large piston

3-37. If a certain force is applied to the small piston, what are the relationships between pressures in various parts of the system?

1. The pressure on the small piston is greater than the pressure on the large piston
2. The pressure on the small cylinder is the same as the pressure acting against the small piston and is greater than the pressure in the large cylinder
3. The pressure in the connecting tube is the same as the pressure in the small cylinder and is greater than the pressure in the large cylinder
4. The pressure is the same on all parts of all surfaces that enclose the liquid

3-38. Let F_1 be the force applied to the small piston and F_2 be the force exerted by the large piston. Which equation represents the relationship between the forces F_1 and F_2?

1. $F_2 - F_1 = 10$
2. $10\ F_1 = F_2$
3. $F_1 + F_2 = 10$
4. $F_1 = 10\ F_2$

3-39. The area of the small piston in a hydraulic press is 3 square inches and the area of the large piston is 75 square inches. If a force of 50 pounds is applied to the small piston, the large piston will (neglecting frictional losses) exert a force of

1. 25 lb
2. 250 lb
3. 725 lb
4. 1,250 lb

3-40. In a hydraulic press, how does the distance the small piston moves compare with the distance the large piston moves?

1. The small piston will always move a greater distance than the large piston
2. The large piston will always move a grater distance than the small piston
3. Both pistons will move the same distance
4. There is no relationship between the movements of the two pistons

Items 3-41 and 3-42 are related to the hydraulic press shown in textbook figure 10-10.

3-41. What is the main function of the check valves?

1. To prevent the liquid from escaping from the large cylinder into the reservoir
2. To prevent the liquid in the reservoir from flooding the small cylinder
3. To make possible several short strokes, instead of one long stroke, with the small piston
4. To allow the large piston to return to its starting position

3-42. What is the principle function of the globe valve?

1. To protect the cylinder from excessive pressure
2. To prevent the liquid in the reservoir from flooding the small cylinder
3. To make possible several short strokes instead of one long stroke with the piston
4. To allow the fluid in the large cylinder to flow back into the reservoir

3-43. A main ballast tank on a submarine is filled with sea water by

1. allowing air to escape from the vents at the top of the tank and allowing water to enter through flood ports at the bottom of the tank
2. pumping air from the tank and pumping water into the tank through the vents at the top
3. pumping it in through the vents at the top of the tank
4. pumping it in through the ports at the bottom of the tank

3-44. How is the water removed from the main ballast tanks when a submerged submarine is surfacing?

1. Motor-driven pumps syphon off the water
2. The water is forced out with high-pressure air
3. The water flows out through ports under the pull of gravity
4. Hydraulic pumps syphon off the water

3-45. The variable ballast tanks on a submarine are filled with sea water by

1. allowing air to escape from the tanks and water to enter through flood ports at the bottom of the tanks
2. pumping air from the tanks and allowing the water to enter through vents at the top of the tanks
3. either of the above methods
4. pumping it in

3-46. Hydraulic machines are used aboard submarines for

1. opening and closing the vent valves of the main ballast tanks
2. raising and lowering the periscope
3. opening and closing the vent valves of the safety tanks
4. all of the above purposes

When answering items 3-47 and 3-48, refer to figure 10-14 of your textbook.

3-47. The purpose of an accumulator in the hydraulic system is to

1. accumulate oil as it is released from the reservoir
2. keep the air in the system at a constant pressure
3. accumulate excess oil which flows past check valves in the system
4. keep the oil in the system under pressure

3-48. To what part, if any, is the piston in the accumulator fastened?

1. A rod which is operated by a crankshaft
2. A rod which is activated by pressurized oil in the reservoir
3. A main flood valve
4. None

3-49. Why is it easier to push a 50-pound barrel up a gangplank than to push a 50 pound box?

1. Rolling friction is less than a sliding friction
2. The shape of a barrel defies gravity better than the shape of a box
3. The barrel has a greater surface to come in contact with the gangplank
4. All of the above reasons
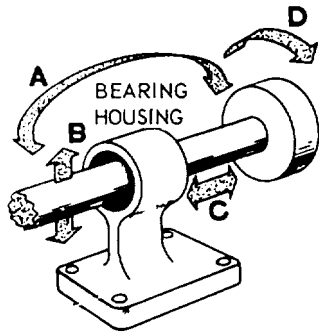
Figure 3C

Items 3-50 through 3-52 are based on figure 3C.

3-50. Which of the following types of bearing is often used in the housing to provide free movement in the direction indicated by arrow C?

1. Thrust bearing
2. Journal bearing
3. Reciprocal motion bearing
4. Tapered roller bearing

3-51. A radial ball bearing used in the housing is superior to a journal bearing for

1. reduction of friction under heavy twisting stress as indicated by arrow A
2. absorption of stress as indicated by arrow B
3. prevention of shaft motion as indicated by arrow C
4. reduction of friction during high-speed rotation of the shaft as indicated by arrow D

3-52. What type of bearing is designed to permit free rotation of the shaft while restraining motion in the direction indicated by arrow C?

1. Radial ball bearing
2. Needle roller bearing
3. Thrust bearing
4. Journal bearing

3-53. The two hardened steel rings of a ball bearing assembly are called the

1. rollers
2. races
3. separators
4. shoulders
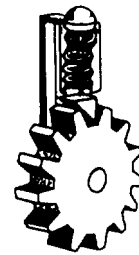
Figure 3D

3-54. The spring in the mechanism shown in figure 3D is used to

1. store energy for part of a functioning cycle
2. force a component to engauge another component
3. return a component to neutral position after displacement
4. counterbalance a weight or thrust

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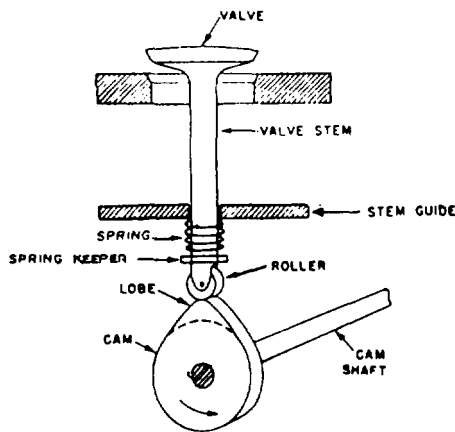
Figure 3E

3-55. The function of the spring in figure 3E is to

1. store energy for part of a cycle
2. counterbalance a weight or a thrust
3. return a component to its original position after displacement
4. permit some freedom of movement between aligned components without disengaging them

3-56. Which of the following types of springs can be used in compression, extension, or torsion?

1. Flat spring
2. Spiral spring
3. Helical spring
4. Each of the above

3-57. What are volute springs?

1. Spiral springs made of plaited strands of cable
2. Helical, conical springs wound with each coil partly overlapping the coil next to it
3. Flat springs made of slightly curved plates
4. Double cone springs with their large ends joined together

3-58. As used in some automotive suspension systems, straight torsion bars reduce shock or impact by

1. compressing
2. twisting
3. bending
4. telescoping

3-59. What gear of the gear differential is fastened to the spider shaft?

1. Input gear
2. End gear
3. Output gear
4. Spider gear

3-60. In the gear differential shown in figure 11-11 of your textbook, in proportion to the sum of revolutions of the end gears, how many revolutions does the spider make?

1. One half as many
2. The same number
3. Twice as many
4. Four times as many

3-61. Which of the following statements is true of a gear differential no matter which type of hook-up is used?

1. The spider will follow the end gears for half the sum or difference of their revolutions
2. The two side gears are the inputs and the gear on the spider shaft is the output
3. The spider shaft is one input, and one of the sides is the other output
4. If the two inputs are equal and opposite, the spider- shaft will move in either direction

3-62. Slightly worn linkages can probably be adjusted by lengthening or shortening the rods and shafts.

1. True
2. False

30

3-63. Rocker arms are a variation of which of the following parts?

1. The clevis
2. The lever
3. The turn buckle
4. The coupling

3-64. The counterbalance weights on the clamps of a sleeve coupling serve to

1. increase speed
2. decrease shaft vibration
3. transmit motion from a link moving in one direction to a link moving in a different direction
4. change rotary motion to linear motion

3-65. The coil spring in an Oldham coupling serves to

1. reduce friction between the coupling disks
2. keep the coupling disks in place
3. make allowance for changes in shaft length
4. strengthen the coupling

3-66. What device is used to couple two shafts that meet at a 15° angle?

1. Sleeve coupling
2. Hooke joint
3. Oldham coupling
4. Flexible coupling

3-67. The amount of whip in shafts coupled by a Hooke joint depends on the

1. strength of the joint
2. number of degrees the shafts are out of line
3. difference in the lengths of the shafts
4. combined weight of the shafts and the joint

3-68. The fixed, flexible, and Oldham couplings have a common use, which is to connect rotating shafts that are

1. perfectly aligned
2. misaligned by more than 25°
3. slightly misaligned
4. severely stressed

3-69. What advantage does a vernier-type coupling have over a sliding lug coupling?

1. Simplicity of operation
2. Strength
3. Flexibility
4. Accuracy of adjustment

3-70. Cams are generally used for all of the following purposes EXCEPT

1. transmitting power
2. changing the direction of motion from up and down to rotary
3. controlling mechanical units
4. synchronizing two or more engaging units

3-71. When the valve of figure 3E is not being lifted by the cam lobe, the cam roller is held in contact with the edge of the cam by the

1. speed of the camshaft
2. spring as it shortens
3. weight of the valve
4. spring as it lengthens

3-72. A function of the clutch in the drive mechanism of a power boat is to

1. permit changes in gear ratio
2. disconnect the engine from the propeller shaft
3. reverse the pitch of the propeller
4. reverse the direction of the engine rotation

3-73. What type of clutch has interlocking teeth?

1. Single disk
2. Cone
3. Hele-Shaw
4. Spiral claw

3-74. Either a positive clutch or a friction clutch may be used in a gear train to

1. obtain a greater mechanical advantage
2. synchronize gear speeds before the gears are meshed
3. permit interruption of power transmission through the train
4. compensate for slight angular misalignment of shafts

3-75. Magnetic and induction clutches differ mainly in the manner in which the

1. movable clutch face is actuated
2. contacting surfaces are lubricated
3. driving and driven faces are brought into contact
4. power is transmitted between the driving and driven members

ASSIGNMENT 4

4-1. An internal combustion engine is a machine that converts

1. heat energy to mechanical energy through the burning of a liquid fuel
2. mechanical energy to heat energy through the burning of a liquid fuel
3. mechanical energy to heat energy through the burning of a fuel-air mixture within itself
4. heat energy to mechanical energy through the burning of a fuel-air mixture within itself

4-2. All internal combustion engines rely on which of the following three things?

1. Oil, water, and air
2. Fuel, water, and ignition
3. Air, fuel, and ignition
4. Air, ignition, and water

4-3. In the operation of a gasoline engine, what event forces each piston downward?

1. Compression of fuel-air mixture
2. Intake of fuel-air mixture
3. Expansion of heated gases
4. Exhaust of waste gases

4-4. What are the four basic parts of a 1-cylinder internal combustion engine?

1. Crankshaft, piston, connecting rod, and cylinder
2. Piston, crankpin, cylinder, and crankshaft bearing
3. Crankshaft bearing, cylinder, connecting rod, and exhaust port
4. Cylinder, intake port, exhaust port, and piston

4-5. In what order do the strokes of a 4-stroke Otto-cycle engine occur during operation?

1. Compression, power, exhaust, intake
2. Compression, power, intake, exhaust
3. Intake, compression, power. exhaust
4. Intake, compression, exhaust, power

4-6. During which complete stroke of a gasoline engine is the cylinder pressure less than atmospheric pressure?

1. Compression
2. Power
3. Intake
4. Exhaust

4-7. Which of the following events occurs during a compression stroke in the 4-stroke Otto-cycle engine?

1. A partial vacuum is created
2. Waste gases are exhausted
3. Volume of air-fuel mixture decreases
4. Temperature of air-fuel mixture decreases

4-8. How are the pressure and temperature affected in an engine cylinder as the air-fuel mixture is compressed?

1. Pressure and temperature decrease
2. Pressure and temperature increase
3. Pressure decreases; temperature increases
4. Pressure increases temperature decreases

4-9. During what stroke in the operating cycle of a 4-stroke Otto-cycle engine is the greatest force exerted on the piston head?

1. Intake
2. Compression
3. Power
4. Exhaust

4-10. Which of the following events occurs during the exhaust stroke in a 4-stroke Otto-cycle engine?

1. Fuel-,air-mixture is ignited
2. Temperature and pressure of mixture increases
3. A partial vacuum is created
4. Burnt gasses are cleared from the cylinder

4-11. The basic difference between the 2-stroke-cycle and the 4-stroke-cycle diesel engine is in the

1. number of pistons
2. piston arrangement
3. number of piston strokes during a cycle of events
4. distance is piston travels during a stroke

4-12. How many crankshaft revolutions are required for each power stroke in a (a) 4-cycle engine and (b) 2-cycle engine?

1. (a) Two (b) one
2. (a) Four (b) two
3. (a) One (b) two
4. (a) Two (b)) four

4-13. Which, if any, of the following components determine(s) the position of the valves?

1. The pistons
2. The camshaft
3. The crankshaft
4. None of the above

4-14. The ignition system is timed so that the spark occurs before the piston reaches TDC on which of the following strokes?

1. Exhaust
2. Intake
3. Power
4. Compression

4-15. Which of the following engine classification methods is the most common?

1. Type of fuel used
2. Cylinder arrangement
3. Valve arrangement
4. Type of cooling used

4-16. Combustion takes place as a result of ignition by what in a (a) diesel engine and (b) gasoline engine?

1. (a) Expansion of compressed gases
   (b) a Spark
2. (a) Heat of compression
   (b) a spark
3. (a) A spark
   (b) heat of compression
4. (a) A spark
   (b) expansion of compressed gases
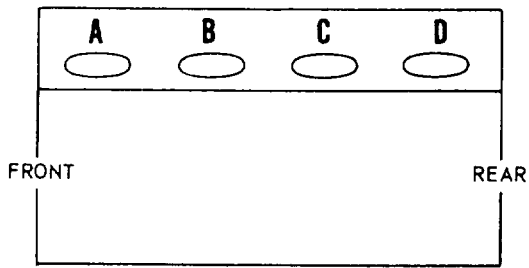
Figure 4A

IN ANSWERING QUESTION 4-17, REFER TO
FIGURE 4A.

4-17. The digits in the firing order of
an engine are the cylinder numbers.
If the firing order of the engine
of figure 4A is 1-4-2-3, in which
order do the cylinders fire?

1. A, B, C, D
2. A, c, B, D
3. A, D, B, C
4. A, D, C, B

4-18. How does the camshaft actuate the
intake and exhaust valves of an
L-head engine?

1. By tappets from a position
    above the valves
2. By tappets from a position
    below the valves
3. By tappets, pushrods, and
    rocker arms from a position
    above the valves
4. By tappets, pushrods, and
    rocker arms from a position
    below the valves

4-19. Which of the following is NOT
considered to be a stationary part
of an engine?

1. The piston assembly
2. The cylinder block
3. The crankcase
4. The cylinder head

4-20. Cylinder sleeves for the blocks of
gasoline and diesel engines are
used for which of the following
purposes?

1. To decrease the wear of the
    cylinder blocks
2. 10 strengthen the cylinder
    blocks
3. To help enclose the heat in the
    cylinder blocks
4. To help make a seal to contain
    the oil within the cylinder
    blocks

4-21. The curved surface of the pockets
in which the valves of an L-head
cylinder head function are designed
for which of the following
purposes?

1. To shorten the compression
    stroke
2. To lengthen the compression
    stroke
3. To decrease the turbulence of
    the air-fuel mixture
4. To increase the turbulence of
    the air-fuel mixture

4-22. Which of the following components
supports and encloses the
crankshaft and provides a reservoir
for the lubricating oil?

1. The cylinder head
2. The exhaust manifold
3. The intake manifold
4. The crankcase

4-23. The waste products of combustion
are carried from the cylinders
through which of the following
means?

1. The intake manifold
2. The exhaust manifold
3. The cylinder head
4. The cylinder block

4-24. Downward motion of the pistons is converted to rotary motion through the action of which of the following components?

1. The valves
2. The gear train
3. The flywheel and the vibration dampener
4. The connecting rod and the crankshaft

4-25. Which of the following parts is NOT a structural component of a piston?

1. The ring grooves
2. The lands
3. The bearings
4. The skirt

4-26. Aluminum pistons will expand more than cast-iron pistons under the same operating conditions. For this reason, they are designed with which of the following types of piston skirts?

1. Split skirts
2. Full trunk skirts only
3. Slipper skirts only
4. Full trunk and slipper skirts

4-27. Which of the following parts secure(s) the piston to the connecting rod?

1. The wrist pin
2. The split skirts
3. The piston rings
4. The ring grooves.

4-28. How do piston rings help an engine perform its work?

1. By sealing the cylinder
2. By distributing and controlling lubricating oil on the cylinder wall
3. By transferring heat from the piston to the cylinder wall
4. All of the above

4-29. The bottom ring on the piston of textbook figure 12-15 serves which of the following purposes?

1. It scrapes combustion products from piston surfaces
2. It transmits oil to the combustion rings
3. It wipes excess oil from the cylinder walls
4. It removes impurities from the oil

4-30. The end of the connecting rod that attaches to the piston must be fitted with a bearing of bronze! or similar material when the piston pin is a

1. full floating pin
2. fixed pin
3. full floating or a fixed pin
4. semifloating pin

4-31. Which of the following parts may be considered the backbone of the engine?

1. The pistons
2. The crankshaft
3. The connecting rods
4. The bearings

4-32. The vibration damper serves what purpose?

1. It balances camshaft speed with crankshaft speed
2. It reduces twisting strain on the crankshaft
3. It brakes the flywheel during engine speed reduction
4. It reduces flywheel vibration

4-33. In addition to reducing engine speed fluctuations, the flywheel often functions in which of the following ways?

1. As a power takeoff for the camshaft and a pressure surface for the clutch
2. As a pressure surface for the clutch and a starting system gear
3. As a starting system gear and a power takeoff for the fuel pump
4. As a power takeoff for the fuel pump and a timing reference for the ignition system

4-34. Which of the following parts is/are NOT included in the valve-actuating mechanism?

1. The pushrods
2. The rocker arms
3. The camshaft
4. The crankshaft

4-35. What is the function of the eccentric lobes on a camshaft?

1. To open the intake and exthaust valves at the proper times
2. To return the intake and exhaust valves to their seats
3. To add to the pressure exerted by the valve springs
4. To regulate the pressure exerted by the valve springs

4-36. Relative to engine speed, how fast does the camshaft of an 8-cylinder, 4-stroke/cycle engine turn?

1. One-eighth as fast
2. One-fourth as fast
3. One-half as fast
4. Twice as fast

4-37. Camshaft followers are the parts of the valve-actuating mechanism that contact the camshaft. Which of the following terms is another name for camshaft followers?

1. Cam lobe
2. Rocker arms
3. Valve stern
4. Valve lifters

4-38. Which of the following mechanisms keep the crankshaft and camshaft turning in the proper rotation to one another so that the valves open and close at the proper time?

1. The pushrods
2. The timing gears
3. The rocker arms
4. The valve mechanisms

4-39. By what means are the timing gears at the camshaft and crankshaft positioned so they CANNOT skip?

1. They are welded
2. They are threaded
3. They fire keyed
4. They are bolted

4-40. In the diesel engine fuel system, which of the following component replaces the carburetor?

1. The fuel injection mechanisms
2. The fuel pump
3. The fuel filter
4. All of the above

4-41. What power train part of a 4-wheel drive heavy truck is NOT part of a 2--wheel drive heavy truck?

1. The differential
2. The multiple disk clutch
3. The 4-speed transmission
4. The transfer case

4-42. What is the function of the clutch in the power train of a motor vehicle that is starting to move forward from a still position?

1. To dampen vibration in the transmission system
2. To allow the brakes to "clutch" or hold until there is enough power for the vehicle to move forward
3. To transmit power to the wheels through the dead axles
4. To allow the engine to take up the load gradually

4-43. If the spring pressure applied to the clutch driving plate is increased rapidly, what, if anything, happens to the amount of clutch slippage?

1. It increases gradually
2. It increases rapidly
3. It decreases rapidly
4. Nothing

4-44. When a truck having a 4-speed transmission is in fourth gear, the propeller shaft and the engine crankshaft rotate at a ratio of

1. 1:1
2. 1:2
3. 2:1
4. 3:2

4-45. A heavy truck with a 7:1 gear ratio in a 4-speed transmission is moving along at 6 miles per hour in low gear. The driver shifts the transmission through second and third to fourth gear. About how fast will the truck be moving in fourth gear if the driver keeps the engine turning at the same rate as it was turning in low gear?

1. 6 mph
2. 30 mph
3. 42 mph
4. 54 mph

4-46. How does the constant mesh transmission reduce noise?

1. By using spur-tooth rather than helical gears
2. By using helical rather than spur-tooth gears
3. By using main shaft meshing gears that are able to move endwise
4. By using soundproof padding around the transmission units

4-47. What is the function of the friction cone clutch in a synchromesh transmission?

1. To engage the main drive gear with the transmission main shaft
2. To engage the first-speed main shaft with the transmission main shaft
3. To equalize the speed of the driving and driven members
4. To engage the second-speed main shaft with the transmission main shaft

4-48. The synchromesh transmission shown in figure 13-10 of your textbook engages the notches at the inner ends of the bell cranks by which of the following means?

1. Shifter forks
2. A first-speed clutch
3. Poppets
4. A dog clutch

4-49. What device usually provides the means for engaging automatically the front-wheel drive on a 6-wheel drive vehicle?

1. The sprag unit
2. The power takeoff
3. The auxiliary transmission
4. The two-way clutch

4-50. In an automotive vehicle the power takeoff that supplies power to the! auxiliary accessories is attached to which of the following units of the power train?

1. The transmission
2. The auxiliary transmission
3. The transfer case
4. Each of the above

4-51. One final drive part of the truck shown in figure 13-1 of your textbook is tile

1. differential carrier
2. rear universal joint
3. propeller shaft
4. transmission

4-52. If the ring gear in a final drive has 21 teeth and the pinion has 7 teeth, the mechanism is probably part of a

1. diesel-powered shovel
2. small tractor
3. six-wheel truck
4. passenger car

4-53. What is the primary purpose of the differential in the rear axle assembly?

1. To connect each of the rear axle shafts together
2. To prevent each of the rear wheel axles from turning at a different speed
3. To boost engine power transmitted to the wheels
4. To permit both drive axles to be driven as a single unit

4-54. Through which parts of the differential is power transmitted directly to the axle shafts?

1. Differential case and side gears
2. Bevel drive pinions and side gears
3. Differential pinions and side gears
4. Differential case and bevel drive pinons

4-55. What parts usually found in conventional automotive differentials are NOT contained in the no-spin differential?

1. Ring gear and spider
2. Pinion and side gears
3. Spring retainer and side member
4. Driven clutch member and cam assembly

4-56. The rear axle housing of a certain truck helps carry the weight of the truck. Which of the following types of live axles is used in the truck?

1. Nonfloating
2. Semifloating
3. Three-quarter floating
4. Each of the above

39

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